STAT

[redacted]

4450-F
FINAL ENGINEERING REPORT
CHIP COMPARATOR MODIFICATION

Declass Review by NGA.

STAT

[redacted]

STAT

4450-F

FINAL ENGINEERING REPORT

CHIP COMPARATOR MODIFICATION

September 1970

STAT

[redacted]

I. INTRODUCTION

This report, the final engineering report for Contract [redacted] STAT describes two modifications designed by [redacted], for the [redacted] STAT STAT [redacted] Chip Comparator. The modifications were installed on four Chip Comparator units and provide for an automatic leak detector on the cooling system and a drive mechanism for the viewer assembly.

Approved For Release 2005/05/20 : CIA-RDP78B04770A001700060023-4

II. COOLING SYSTEM MODIFICATION

To keep the high intensity viewing lamp at a tolerable temperature during operation, a closed cycle, water cooling system is used. The original system used a closed-circuit water cooling system consisting of a pump, coil around the lamp and a reservoir of water. Water leakage occured around the tubing entering the reservoir. After a period of time, the water level of the reservoir dropped to a point where no water was being pumped through the cooling system; therefore, the lamp temperature rose and eventually the lamp burned out. At the same time, the water that had leaked out of the reservoir penetrated the electrical system (relays, cables, fuses, etc.) causing the fuse to blow, thereby disabling the system.

Replacement of the lamp was expensive and since this is a special lamp, it is not readily available, thus a long "machine-down" condition existed. Water penetration of the electrical system required that the machine be disassembled and completely cleaned. Replacement of some components was sometimes necessary.

To alleviate this problem, the cooling system was modified to alert the operator and/or maintenance personnel in case of malfunction. The modifications consists of (1) replacing the plastic water reservoir with a metal reservoir. The metal reservoirs were fabricated to include a tray which would catch any water leakage. This was done to prevent water from leaking into the electrical parts of the system. (2) Water level sensors were placed in the reservoir. When the water gets appreciably low, a red light on the Chip Comparator front panel lights, warning the operator that water needs to be added to the reservoir. There is a light for both X and Y axis. (3) Water pressure sensors were installed to monitor water pressure in the cooling system. When the pressure drops to a dangerous level (when insufficient cooling of the high-intensity lamp occurs) the red light and a buzzer operate. This warns the operator of a major malfunction and that he should then shut the power off to the Chip Comparator. Again this is done for both X and Y axis. (4) A green light for each axis is on when both X and Y systems are operating normal.

A schematic diagram of the cooling system alarm circuit is enclosed.

III. VIEWER ASSEMBLY DRIVE SYSTEM MODIFICATION

The viewer assembly on the chip comparator must be moved vertically from time to time to correct the focus.

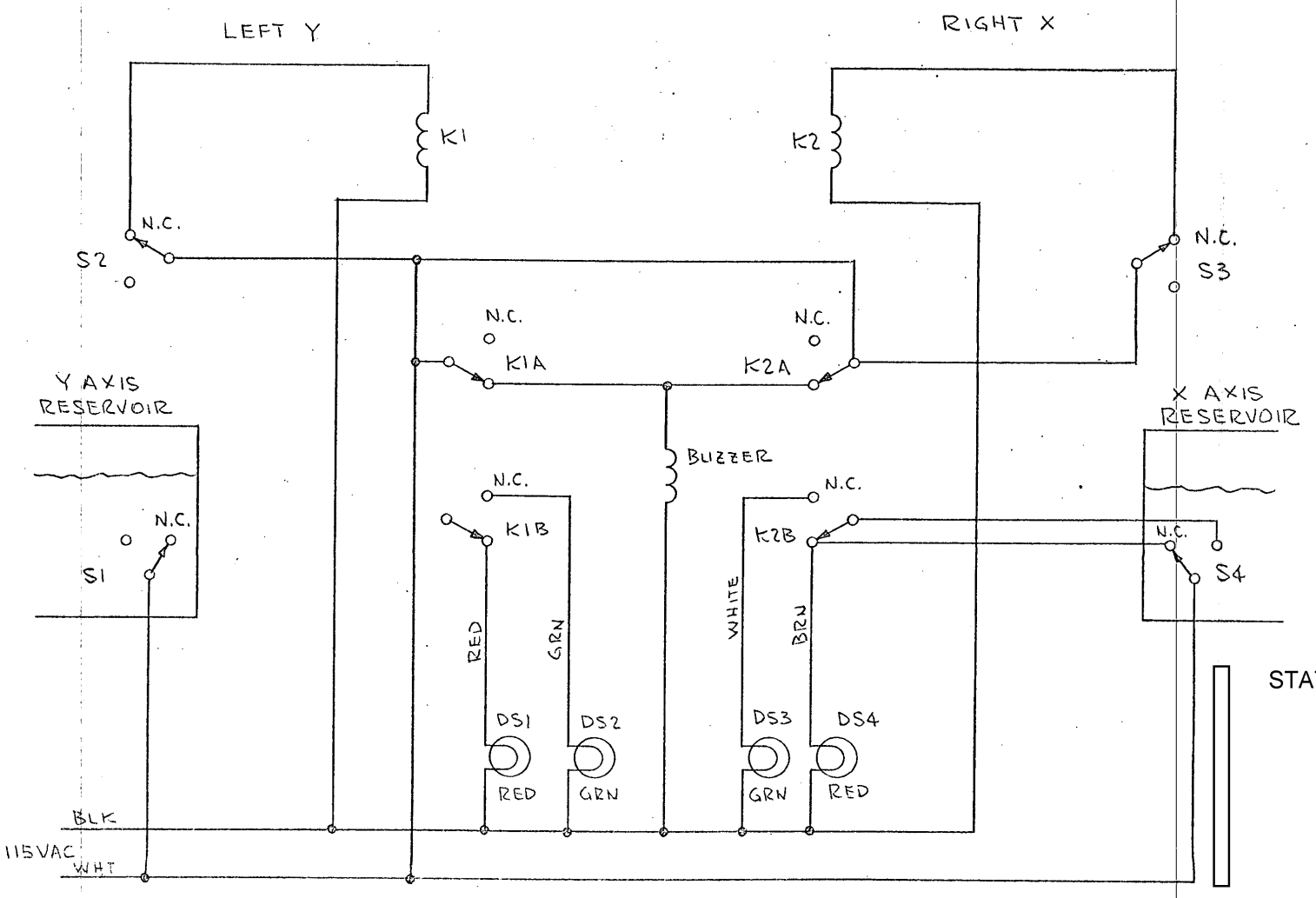
The original drive consisted of a worm-speed reducer and spur gear driving a rack gear which was attached to the optical head support bracket. Two dovetail joints were employed to guide the 15-pound optical head. The arrangement enables one to move the optical head up and down for focusing. However, clamping of the optical head after positioning was an inadequate operational arrangement for an optical comparator because it affected the focusing. The original arrangement did not employ precision anti-backlash gearing. This lack of any anti-backlash gearing was also responsible for some of the focusing difficulties .

To correct these problems, the drive mechanism was replaced with a precision ball nut and anti-backlash worm-speed reducer assembly. The key elements of the new mechanism are four precision miniature ball nuts. Two ball nuts are tightened against each other to eliminate backlash between the nuts and the screw. The screws are housed in a precision machined bracket which attaches to the Optical Comparator Arm. Anti-backlash meter gear sets coupled to the worm-speed reducer drive the ball screws.

Precision bearings having ABEC-7 tolerances are also employed for smooth and accurate movement.

The gear ratio of the gear drive is 40:1 and the ball screw has a lead of .125 inches. Therefore, every 360 degree turn of the hand wheel on the worm-speed reducer will result in a .003125 inch travel of the optical head.

The optical head mounting bracket has been modified to allow the operator to level the head by loosening the screws holding the bracket in place, and turning the slotted cam which moves the bracket up and down, while viewing an object. When the optical head is focused, tighten the screws.



COOLING SYSTEM SCHEMATIC

Approved For Release 2005/05/20 : CIA-RDP78B04770A001700060023-4